IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	: 10/635,864	Confirmation No.: 2116
Applicant	: LOVEDAY *et al.*	
Filed	: August 6, 2003	
TC/A.U.	: 1796	
Examiner	: William K. Cheung	
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Customer No.	: 25959	
Date	: April 14, 2009	

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Amendment and After Final Response Under 37 C. F. R. § 1.116

Dear Sir:

This amendment is submitted in response to the Final Office Action dated January 14, 2009. Please reconsider the application in light of the following remarks.

In the Claims

1. (Previously presented) A bimodal polyethylene comprising ethylene derived units and units derived from at least one of a C_4 to C_{12} olefin;

wherein the polyethylene has a density of from 0.940 to 0.970 g/cm^3;

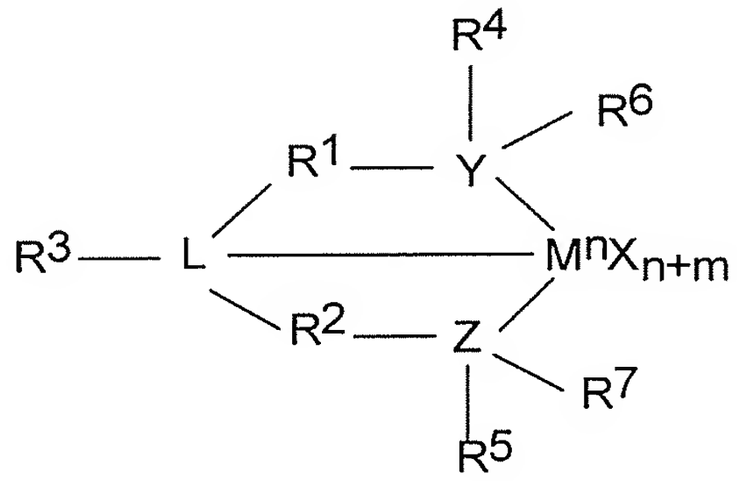
an I_{21}/I_2 of 80 or more;

a residual zirconium or hafnium metal content;

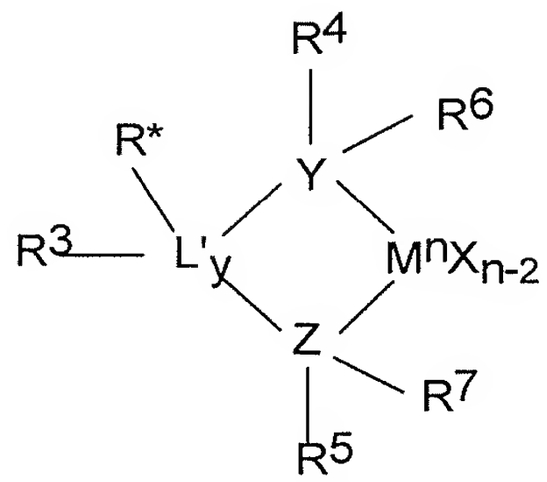
a Mw/Mn of from 20 to 60; and

wherein the polyethylene comprises a high molecular weight component and a low molecular weight component, the high molecular weight component present from 40 to 60 weight percent based on the total polyethylene, and wherein the high molecular weight component has a weight average molecular weight Mw of greater than 100,000 a.m.u., and wherein the high molecular weight component has a Mw/Mn between 4.50 and 6.88,

wherein said bimodal polyethylene is formed in a single reactor by contacting olefins and a catalyst composition comprising a Group 15 containing compound and a bulky ligand metallocene catalyst compound; wherein the Group 15 containing metal compound is represented by the formulae:



or



wherein M is a Group 4, 5 or 6 metal;

each X is independently a leaving group;

y is 0 or 1;

n is the oxidation state of M;

m is the formal charge of the ligand comprising the YZL or YZL' groups;

L is Nitrogen;

L' is a Group 15 or 16 element or Group 14 containing group;

Y is Nitrogen;

Z is Nitrogen;

R^1 and R^2 are independently a C_1 to C_{20} hydrocarbon group, a heteroatom containing group having up to twenty carbon atoms, silicon, germanium, tin, lead, or phosphorus;

wherein R^1 and R^2 may be interconnected to each other;

R^3 is absent or a hydrocarbon group, hydrogen, a halogen, a heteroatom containing group;

R^4 and R^5 are independently an alkyl group, an aryl group, substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, a cyclic arylalkyl group, a substituted cyclic arylalkyl group or a multiple ring system;

wherein

R^4 and R^5 may be interconnected to each other;

R^6 and R^7 are independently absent, hydrogen, an alkyl group, halogen, heteroatom or a hydrocarbyl group;

R^* is absent, hydrogen, a Group 14 atom containing group, a halogen, or a heteroatom containing group, and

wherein a polyethylene pipe comprising the bimodal polyethylene has a predicted D-4 Tc for 110 mm pipe of less than -5°C when tested according to ISO DIS 13477/ASTM F1589.

2. (Original) The bimodal polyethylene of Claim 1, possessing an I_2 of 0.5 g/ 10 min or less.

3. (Original) The bimodal polyethylene of Claim 1, wherein the weight average molecular weight Mw of the high molecular weight component is greater than 150,000 a.m.u.

4. (Original) The bimodal polyethylene of Claim 1, wherein the weight average molecular weight Mw of the high molecular weight component is greater than 200,000 a.m.u.

5. (Previously Presented) The bimodal polyethylene of Claim 1, wherein the zirconium or hafnium metal residuals content is 1.5 ppm to 5.0 ppm.

6. (Original) The bimodal polyethylene of Claim 1, wherein the value of I_{21}/I_2 is greater than 90.

7. (Previously Presented) The bimodal polyethylene of Claim 1, possessing a notch tensile test result of greater than 150 hours at 3.0 MPa when determined according to ASTM-F1473.

8. (Original) The bimodal polyethylene of Claim 1, wherein a pipe with carbon black formed from the polyethylene is able to withstand at least 50 years at an ambient temperature of

20°C, using water as the internal test medium and either water or air as the outside environment (Hydrostatic (hoop) stress as measured by ISO TR 9080).

9. (Previously Presented) The bimodal polyethylene of Claim 1, wherein a pipe with carbon black formed from the polyethylene possesses a predicted S-4 Tc for 110 mm of less than -40°C when determined according to ISO DIS 13477 / ASTM F1589.

10. (Original) The bimodal polyethylene of Claim 1, wherein a pipe with carbon black formed from the polyethylene possesses a predicted S-4 Tc for 110mm pipe of less than -15°C (ISO DIS 13477/ASTM F1589).

11. (Original) The bimodal polyethylene of Claim 1, wherein when formed into a 0.5mil (13μ) film possesses an MD Tear of between about 5 g/mil and 25 g/mil.

12. (Original) The bimodal polyethylene of Claim 1, wherein when formed into a 0.5 mil (13μ) film possesses an MD Tear of between about 15 g/mil and 25 g/mil.

13. (Cancelled)

14. (Previously Presented) The bimodal polyethylene of Claim 1, wherein the zirconium or hafnium metal residuals content is 1.6 ppm to 5.0 ppm.

15. (Previously Presented) The bimodal polyethylene of Claim 1, wherein the zirconium or hafnium metal residuals content is 1.8 ppm to 5.0 ppm.

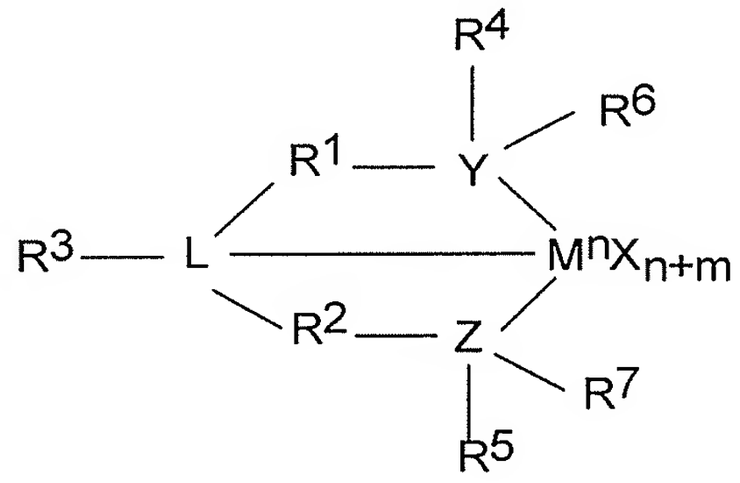
16. (Previously Presented) The bimodal polyethylene of Claim 1, wherein the zirconium or hafnium metal residuals content is 2.0 ppm to 5.0 ppm.

17. (Cancelled)

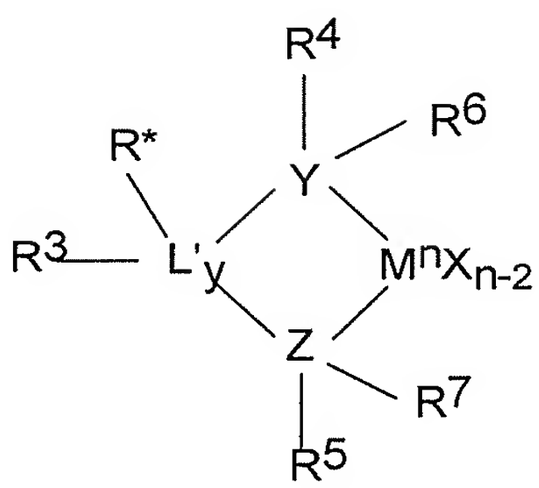
18. (Previously Presented) The bimodal polyethylene of Claim 1, wherein the zirconium or hafnium metal residuals content is 1.6 ppm to 2.0 ppm.

19. (Cancelled)

20. (Previously presented) A bimodal polyethylene consisting of ethylene derived units and units derived from at least one of a C_4 to C_{12} olefin; wherein the polyethylene consists of a density of from 0.940 to 0.970 g/cm^3 an I_{21}/I_2 of 80 or more; a residual zirconium or hafnium metal content; a Mw/Mn of from 20 to 80; and wherein the polyethylene consists of a high molecular weight component and a low molecular weight component, the high molecular weight component present from 40 to 60 weight percent based on the total polyethylene, and wherein the high molecular weight component has a weight average molecular weight Mw of greater than 100,000 a.m.u., and wherein the high molecular weight component has a Mw/Mn between 4.50 and 6.88, wherein said bimodal polyethylene consists of a nitrogen containing ligand detectable by High Resolution Mass Spectroscopy (HRMS), wherein said bimodal polyethylene is formed in a single reactor by contacting olefins and a catalyst composition comprising a Group 15 containing compound and a bulky ligand metallocene catalyst compound; wherein the Group 15 containing metal compound is represented by the formulae:



or



wherein M is a Group 4, 5 or 6 metal;

each X is independently a leaving group;

y is 0 or 1;

n is the oxidation state of M;

m is the formal charge of the ligand comprising the YZL or YZL' groups;

L is Nitrogen;

L' is a Group 15 or 16 element or Group 14 containing group;

Y is Nitrogen;

Z is Nitrogen;

R^1 and R^2 are independently a C_1 to C_{20} hydrocarbon group, a heteroatom containing group having up to twenty carbon atoms, silicon, germanium, tin, lead, or phosphorus; wherein R^1 and R^2 may be interconnected to each other;

R^3 is absent or a hydrocarbon group, hydrogen, a halogen, a heteroatom containing group;

R^4 and R^5 are independently an alkyl group, an aryl group, substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, a cyclic arylalkyl group, a substituted cyclic arylalkyl group or a multiple ring system;

wherein

R^4 and R^5 may be interconnected to each other;

R^6 and R^7 are independently absent, hydrogen, an alkyl group, halogen, heteroatom or a hydrocarbyl group; and

R^* is absent, hydrogen, a Group 14 atom containing group, a halogen, or a heteroatom containing group, and

wherein a polyethylene pipe comprising the bimodal polyethylene has a predicted D-4 Tc for 110 mm pipe of less than -5°C when tested according to ISO DIS 13477/ASTM F1589.

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REMARKS

Reconsideration of the application is respectfully requested.

Claims 1-12, 14-16, 18, and 20 are currently pending. Claims 13, 17, and 19 were previously cancelled.

Double Patenting

Claims 1-12, 14-16, 18, and 20 stand provisionally rejected over USSN 10/772,823.

Upon indication of allowable subject matter in the present case, an appropriate Terminal Disclaimer will be filed.

Rejection Under 35 U.S.C. §102 and/or 35 U.S.C. §103

The Action maintains the rejection of Claims 1-12, 14-16, 18, and 20 under 35 U.S.C.§ 102(b) as being anticipated by or, in the alternative, under 35 U.S.C.§ 103(a) as obvious over U.S. Patent No. 5,124,418 to Welborn (Welborn.) Applicants respectfully disagree.

As claimed, the bimodal polyethylene has a high molecular weight component having a molecular weight distribution between 4.5 and 6.88. The Action notes that Welborn discloses a molecular weight distribution range from 2.5 to 100. The broad range demonstrates that Welborn fails to disclose or suggest a polymer having the properties of an inventive polymer produced according to Applicants' presently claimed invention. In order to facilitate prosecution, Applicants provide the following test results to show the novel and non-obvious difference of polymers produced according to Applicants' presently claimed invention over the polymers produced according to Welborn.

The claimed polyethylene was tested, as was the comparative polymer of Welborn according to ISO-4437, Buried polyethylene (PE) pipes for the supply of gaseous fuels-Metric series-Specifications." Attachment 3 is an excerpt from ISO-4437, which shows the

requirements for S-4 Rapid Crack Propagation Testing according to ISO-13477, and Notched Pipe Slow Crack Growth according to ISO-13479.

ISO 13479 rapid crack propagation (RCP) pressure testing is similar to ASTM-F1473 as recited in Claim 7. ISO 13479 is related to Applicants' recited ISO 13477 testing, the difference being that ISO 13477 specifies a small-scale test for determination of arrest or propagation of a crack initiated in a thermoplastic pipe at a specified temperature and internal pressure. The aim is to assess the performance of thermoplastics pipes that are intended for the supply of gases or liquids, in the latter case air may also be present in the pipe.

In ISO 13477 testing, a section of a thermoplastic test pipe of a specific length, maintained at a specified test temperature, containing a fluid at a specified test pressure, is subjected to an impact, near one end, in order to initiate a fast running longitudinal crack. The test temperature and test pressure are defined in the appropriate standards. The fluid is either identical to the one used in the intended application or an equivalent substitute. Rapid decompression ahead of the propagating crack is retarded by internal baffles and by an external cage which restricts flaring of the test pipe at the edges of the fracture. Hence this technique achieves steady-state rapid crack propagation (RCP) in a short pipe specimen at a lower pressure than in a full-scale test. The tested pipe is examined to determine whether arrest or propagation of the crack has occurred. From a series of tests at different pressures and at constant temperature, the critical pressure or the critical hoop stress for RCP can be determined. Similarly the critical temperature for RCP can be determined by testing at different temperatures at constant pressure or hoop stress.

ISO 13479 specifies a method to determine the resistance to slow crack growth of polyolefin pipes. The test consists of a hydrostatic pressure test on a pipe with machined longitudinal notches on the outside surface and the result is expressed in terms of time to failure. The test is applicable to pipes of a wall thickness greater than 5 mm. Four notches are introduced on a minimum of three pipes. The notched pipes are then subjected to hydrostatic pressure testing in tap water. When the pipes have failed or have been terminated the remaining ligament thickness is checked.

The system standards and the test conditions and requirements are specific to each material. For PE-100 test conditions, all testing is performed using tap water at 80 C as test media. To obtain PE-100 status, the polymer must meet a variety of conditions. For example, to be considered PE-100 grade, the polymer must withstand a pressure of 8.0 bar, and a failure time of >500 h.

Attachment 1 is a copy of Notebook Page 1163-18, February, 2007, which shows the preparation of a polymer of the instant invention (referred to as BMC-200), along with S-4 Rapid Crack Propagation Testing results of the polymer measured consistent with ISO-13477, and Notched Pipe Slow Crack Growth results of the polymer as measured consistent with ISO-13479, which testing is specified by ISO-4437.

In Attachment 2, the data tables in the center of Note Book Page 1163-18 have been reproduced for the Examiner's convenience. In the table:

the term "DI" refers to the dispersity index (Mw/Mn);

the term "_L" refers to the low molecular weight portion of the polymer;

the term "_H" refers to the high molecular weight portion of the polymer;

the term "comon" refers to the co-monomer; and

the term "C6" refers to hexene.

Catalyst HN5/X-1 is a combination of HN5 and X-1 according to the instant disclosure, wherein HN5 represents bis(2-pentamethylphenylamido)ethyl)zirconium dibenzyl and X-1 represents (tetramethylcyclopentadienyl)(n-propylcyclopentadienyl)zirconium dichloride.

As the data clearly shows, the instant polymer meets the requirements for both S-4 Rapid Crack Propagation Testing according to ISO-13477, and Notched Pipe Slow Crack Growth according to ISO-13479, as specified by ISO-4437.

A comparative polymer was produced according to Welborn using a metallocene and a Ziegler-Natta catalyst to produce a bimodal polymer. The properties of the polymer are shown in Attachment 4 (named HDX891 herein) and evaluated by ISO-13479 and ISO-13477 testing. Attachment 5 is an excerpt from the testing report of HDX891, which shows that the Welborn material fails both the rapid crack propagation testing and the slow crack growth testing requirements of ISO-4437.

The values obtained in the comparative examples thus demonstrate that polymers produced according to Welborn do not inherently possess the properties obtained by Applicants' presently claimed invention. In any event, polymers produced according to Welborn fail to meet the standards associated with PE-100 grade material, which is in contrast to Applicants' presently claimed invention. Accordingly, the polymer produced according to the presently claimed invention is both novel and non-obvious over Welborn as demonstrated by the superiority of the instant polymers over polymers produced according to Welborn.

Applicants respectfully request that all rejections be withdrawn and solicit a prompt notice of allowability. In the alternative, Applicants invite the Office to telephone the undersigned attorney if there are any other issues outstanding which have not been presented to the Office's satisfaction.

Respectfully submitted,

April 14, 2009
Date

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